

USP174954A

Rec'd PCT/FTO 11 AUG 2004

10/522945

## Cable storage

The present invention refers to a cable storage comprising a housing with a cable arranged therein, wherein the housing comprises at least one cable inlet and one cable outlet, and wherein the cable is inserted into the housing in substantially concentric circles, and enters the housing through the cable inlet  
5 and exits through the cable outlet, wherein cable inlet and cable outlet are arranged on the outer periphery of the housing.

When laying or repositioning cables, the problem frequently arises that an additional cable is required at a later time, which is then joined with the already  
10 laid cable via connection elements. This procedure is, on the one hand, very time-consuming and at the same time cost-intensive, since depending on the type of the cable the required connection elements are expensive. Additionally, any additional connection portion in a cable means that losses in the transmission cannot be excluded.

15 Particularly when glass fibre cables are laid or repositioned it is required for every connection portion to remove a part of the cable. Furthermore, the connection elements are very expensive, the installation is very time-consuming and at the same time losses in the transmission cannot be  
20 excluded.

In order to overcome this disadvantage, it is already known to lay a cable surplus when laying cables, which is then kept in a cable storage for a later use. In this case, the cable surplus is usually wound up to circles and inserted  
25 into this cable storage. However, the removal of the cable is often very complex. Particularly when glass fibre cables are laid or repositioned it must be taken into consideration that when removing the additional cable, the risk of damage, particularly the risk of a fracture of the glass fibres of the glass fibre cable exists, since these glass fibres must not be bent or buckled.

Thus, it is the object of the invention to provide a cable storage of the generic type, which ensures a simple removal of the cable.

- 5 This object is solved by a cable storage of the known type in that the cable is inserted according to an insertion pattern which is selected such that parts of the cable are pre-twisted in different directions.

- 10 It is enabled for the first time by the insertion of the cable according to the invention to simply remove the cable from the cable storage and to further process it without elaborate additional unwinding steps being necessary to remove the twists or twines of the cable produced during the conventional winding-up process. In this manner is it possible to arrange or store the cable storage on the most different locations, since the removal of the cable can also  
15 be implemented in a very confined space.

- According to a preferred embodiment it may be provided that the cable first of all takes the shape of an eight, and subsequently the upper circular element of the eight formed abuts the lower element to obtain one single circular element  
20 which can be inserted into the cable storage. This special winding-up mode ensures that the cable is pre-twined or pre-twisted so that the turns/convolutions or twists introduced into the cable mutually automatically compensate with respect to each other when removing the cable. Moreover, this insertion pattern can be obtained very simply and quickly without any  
25 additional means.

- Advantageously, the circular elements, which are abutted against each other, may form the upper circular element for a further eight to be laid by the cable. Thus, it is possible to pre-twine also larger amounts of cable in a simple  
30 manner according to the demands of claim 1, wherein the effort remains constantly low.

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It has proven to be especially advantageous if the one cable end lies on top of the other cable end at each crossing process of the cable ends. This feature is especially proved and tested in the laying of ribbon cables.

- 5 According to another preferred embodiment, the cable may be inserted as a winding body, comprising an even number of individual windings, wherein the one cable end crosses the other cable end in each crossing processing one time above and one time below. This insertion pattern also fulfils the conditions of claim 1.

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- According to another embodiment it may be provided that the housing comprises at least one housing frame and a cover. The design of the cable storage with a cover enables the easy access to the cable located in the cable storage, since this cable can simply be removed after removing the cover. The housing frame may stay at its selected position so that the effort of removal can be reduced.

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- Advantageously, each housing frame may be formed as a U-shaped belt with two parallelly extending U-legs and a semi-circular base portion integrally formed with the U-legs. The internal diameter of the semi-circular base portion may be slightly larger than the diameter of the cable inserted in concentric circles. Furthermore, the length of the U-legs may at least correspond to the radius of the semi-circular base portion. The design of the one end of the cable storage as a semi-circle therefore serves on the one hand for the safe arrangement of the cable wound-up, since this cable may be inserted in abutment to the semi-circular portion and is thereby held in a dimensionally stable manner. At the same time, the space requirement is restricted as far as possible by the shape of the cable storage selected.

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- 30 According to another preferred embodiment, the two U-legs of the housing frame may be connected to one another at least on their ends opposing the base portion via a detachably attached bracing element, which extends between the opposing inner sides of the U-legs. This bracing element ensures that the housing frame is dimensionally stable also after removing the cover

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and is not pressed apart by the cable inserted, whereby at the same time the cable may lose the wound-up shape.

5 Advantageously, it may be provided that two spaced apart bracing elements are provided on the ends of the U-legs opposing the base portion, wherein one bracing element is arranged on the side facing the bottom and one bracing elements is arranged on the side facing the cover. This feature also serves for stability of the housing frame and particularly ensures the dimensional stability.

10 Furthermore, it may prove to be advantageous if the U-legs are connected to one another through at least two detachably attached bracing elements extending in parallel to one another and spaced apart from one another, wherein one bracing element is arranged on the ends of the U-legs opposing the base portion and one bracing element is arranged in the proximity of the  
15 ends of the U-legs facing the base portion. It may also be provided that two bracing elements extending in parallel to each other and being spaced apart from each other are arranged on the ends of the U-legs opposing the base portion and in the proximity of the ends of the U-legs facing the base portion, wherein one of the bracing elements is arranged on the side facing the bottom  
20 and one bracing element is arranged on the side facing the cover.

These additional bracing elements increase stability. At the same time, the bracing elements provide an additional protection of the inserted cable in the cable storage, since this cable is particularly passed between the bracing  
25 elements extending in parallel to one another arranged in the proximity of the base portion, and may be held between these elements. The detachable attachment of the bracing elements enables a simple removal of the inserted cable, since this cable can be inserted in a simple way, and the bracing elements can also be attached afterwards. This is particularly required when  
30 inserting rigid cable rollers, e. g. made of glass fibre. The additional bracing elements also enable that the cable storage is attached on the wall without there being a risk when removing the cover, e.g. of the cable from falling out.

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The bracing elements are advantageously formed with a square cross section. This shape has proven in practical application.

Furthermore, it may be provided that each bracing element comprises at least one passage opening, which is formed approximately in the centre of the bracing element and which opens towards the bottom or cover. This passage opening enables for instance to attach the bracing element on a wall or to connect the cover with the bracing elements.

According to a further preferred embodiment it may be provided that in the area of the semi-circular base portion a bottom element is arranged. The bottom element may adjoin the lower edge of the semi-circular portion on the end opposing the U-leg and it may extend approximately across half of the radius of the semi-circular portion towards the U-legs.

This bottom element serves on the one hand for supporting the cable in the housing, since thereby a rest surface for the wound-up cable is provided at least in the case of a lying storage, at the same time the curvature of the semi-circular element is clearly defined and kept dimensionally stable through this bottom element. It has proven in practice that it is fully sufficient if only a part of the semicircular portion is held by the bottom element so that the production costs can be kept possibly low.

According to a further preferred embodiment it may be provided that a plurality of housing frames are detachably arranged on top of each other. This makes it possible on the one hand to stack several cables, wherein each cable can be removed individually. At the same time, one single cable may also be laid to several circles connected to one another, wherein each individual circle, comprising a plurality of windings, can be inserted into one single housing frame separate from the other ones. In this case it is also possible, depending on the cable need, to only remove the cable stored in one single housing, to remove the respective housing frame and to subsequently screw-on the cover again so that the cable storage does not occupy unnecessary space.

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Advantageously, a connection element may be arranged between two housing frames arranged on top of each other, said connection element providing a detachable connection between the two housing frames. The connection element may be arranged in the lower area of the outer side of the housing frame which is on top in the assembled condition, it may extend across the entire outer periphery of the housing frame and in assembled condition it may project by a predetermined length towards the lower housing frame. Furthermore, the connection element may have a seal. These embodiments ensure a safe attachment of two housing frames with one another, wherein at the same time protection is provided.

According to a further embodiment, the cable inlet and the cable outlet may be arranged in a semi-circular portion and may be formed as a recess opening towards the upper edge. Advantageously, the cable inlet and the cable outlet may be formed by a through opening extending along the outer periphery, said through opening opening via a recess centrally formed in the upper longitudinal side towards the upper edge. Furthermore, the cable inlet and the cable outlet may be arranged in a manner opposing one another. If the cable inlet and the cable outlet are formed as an elongate recess, this enables a greater flexibility when laying the cables, since the final insertion or removal position of the cables does not yet have to be defined but said cable can freely be moved over the entire area of the opening. This is particularly meaningful if rigid cables are laid that cannot easily be brought into another position so that in the case of a fixed predetermined opening elaborate laying work is often necessary.

It may advantageously further be provided that the cover is formed slightly larger than the surface formed between the U-legs and the semi-circular base portion, wherein the cover is provided on its edge with a border extending downwards towards the housing. This ensures that the cover sits well on the housing frame, wherein the peripheral border at the same time effects a fixing of the cover.

Advantageously, the cover may be provided in the area of the border with through openings for detachably fixing the cover to the housing frame.

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Furthermore, the cover may at least comprise a through opening for the releasable connection with at least one bracing element.

Furthermore, it may be provided that the housing frame is provided with holding  
5 projections on both sides on the outer side of the U-legs. The holding  
projections may be formed on ends of the U-legs opposing the semi-circular  
base portion. Advantageously, the holding projections may be formed as an  
angle plate. The holding projections enable the attachment of the cable storage  
if a wall fastening takes place, wherein the positioning of the holding projections  
10 on the ends of the U-legs take care that the inserted cable is in fixed abutment  
with the semi-circular base portion and is thereby held in its position. Although  
the holding projections may also be used for a fastening on the floor, this,  
however, is usually not required.

15 Advantageously, the individual components of the cable storage are made of  
metal, e.g. steel, stainless steel, aluminium, plastics or any other suitable  
material. Consequently, the different materials can be used and may be  
selected according to the respective application. At the same time,  
combinations of different materials may be used, e.g. plastics and metal.  
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Subsequently, the invention will be described in detail by means of preferred  
embodiments with reference to the attached drawings.

Fig. 1 shows a three-dimensional view of a cable storage, with a housing frame  
25 and a cover attached therein,

Figure 2 shows the cable storage shown in Figure 1, wherein the cover was  
removed,

30 Figure 3 shows a cable storage, wherein two housing frames were attached on  
top of one another,

Figure 4 shows the cable storage shown in Figure 3 with the cover being  
removed,

Figure 5 shows one single housing frame of the cable storage shown in Figure 3,

- 5 Figure 6 shows a cable storage attached to the wall with the cable being inserted,

Figure 7 shows the cable storage shown in Figure 6 with the cover being removed,

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Figures 8 to 10 show an example of the winding-up process of the cable, and

Figures 11 and 12 show a further example of a winding-up process of the cable.

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Figure 1 shows a first embodiment of a cable storage 1 in a three-dimensional view with a housing frame 2 as well as a cover 3 attached thereon. The cover has the shape of a closed U formed by two U-legs extending in parallel to each other and a semi-circular base portion. The cover rests on the housing 2 and is held there by a border 4 connected to the outer edge of the cover. In the closed condition the inner side of the border 4 of the cover rests on the outer side of the housing frame 2 and thereby holds the cover on the frame. The connection between the cover and the housing frame can be formed as a press seat.

- 25 The structure of the housing frame is shown in detail in Figure 2, which shows a housing frame 2 with the cover being removed. The housing frame 2 is formed as a u-shaped bent belt, consisting of two U-legs 5, 5' extending in parallel, as well as a semi-circular base portion 6 formed integrally with the U-legs 5, 5', said base portion extending between the U-legs. The belt is arranged such that the one side of the belt forms the inner side of the housing and the other one forms the outer side of the housing. The semi-circular base portion 6 comprises a bottom element 7 on its side located downwards in use, said bottom element being arranged in the base portion such that the lower side of the bottom element 7 forms a plane with the lower edge 10 of the base portion
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6. The bottom portion 7 is formed as a circular section, i.e. it extends over the end of the base portion 6 opposing the U-legs 5, 5' up to approximately half of the base portion 6. The bottom element 7, consequently, only closes off approx. half of the base portion 6 in downward direction. The finishing edge 8 of the bottom element extends perpendicularly to the U-legs 5, 5'.

The U-legs are formed integrally with the base portion 6 and extend in parallel to each other. The length of the U-legs corresponds to at least the radius of the base portion 6.

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The two U-legs 5, 5' are connected to one another through four bracing elements 9 extending between the inner sides of the U-legs 5, 5'. The individual bracing elements 9 extend in parallel to each other and in parallel to the edge 8 of the bottom element and perpendicular to the U-legs 5, 5'. Two bracing elements each are arranged on top of each other at a predetermined distance to one another and finish on the one side with the lower edge 10 of the U-legs 5, 5' and the upper edge 11 of the U-legs 5, 5', respectively. Consequently, two bracing element pairs are formed. At the same time, the bracing elements may also be arranged offset with respect to each other.

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One of the bracing element pairs 9 is, as shown in the Figures 9, arranged on the ends of the U-legs 5, 5' opposing the base portion 6, and therefore also finish together with the side edge of the U-legs. The other pair of the bracing elements 9 is arranged in the proximity of the base portion 6, i.e. in the proximity of the transition of the base portion 6 to the U-legs 5, 5'. This bracing element pair is preferably arranged between the transition to the base portion 6 and approximately half of the U-legs 5, 5'.

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Each bracing element 9 has a rectangular cross section and is fastened to the U-legs 5, 5' by means of screws. Any other suitable releasable connection may also be used. For this purpose, the U-legs are provided with correspondingly arranged through openings, through which a connection element can be inserted for fixing the bracing elements 9. The bracing elements are moreover

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centrally provided with a through opening 12, which is arranged such that it opens towards the bottom and the cover.

5 In use a cable roller (not shown) is inserted into the housing frame such that this cable roller rests on the bottom portion 7 as well as on the bracing elements arranged on the lower edge 10. It is possible to first of all insert the cable roller and to subsequently use and fix the bracing elements 9 associated to the upper edge 11.

10 In the area of the base portion 6 the cable inlet 13 and the cable outlet 14 are formed in a manner opposing each other. The cable of the wound-up cable roller is guided through these openings. The cable inlet 13 and the cable outlet 14 are formed identically and have the shape of an elongate through opening, i.e. a through opening that extends in the peripheral direction, wherein the  
15 opposing narrow ends are formed as semicircles. The through opening 15 is provided on its upper edge, i.e. on the edge facing the cover, with an outlet opening 16, which extends over a short central portion only, and which provides an opening of the through opening to the upper edge 11 so that a cable to be inserted can easily be inserted through the outlet opening 16 into  
20 the through opening 15.

The housing frame 2 further has holding elements 17 on both sides on the ends of the U-legs 5, 5' opposing the base portion. The holding elements 17 are formed as angle elements comprising two webs 18, 19 arranged  
25 perpendicularly with respect to each other, wherein the holding element 17 is arranged on the U-legs 5, 5' such that a web 18 of the holding element 17 extends over a section of the outer side of the U-legs and finishes with the lower edge 10 and that the web 19 extends perpendicular to the outer side.

30 The web 18 as well as the web 19 is provided with receiving openings to fix the holding element 17 on the one hand to the U-leg 5 and 5', respectively, and on the other hand e.g. to a wall.

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As shown in Figure 3, two housing frames can be stacked, wherein each housing frame 2 is formed identical and only the uppermost housing frame 2 is covered by the cover 3. Only the lowermost housing frame 2 comprises the holding elements 17.

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A connection element 21 is formed between the two housing frames 2, which extends between the two housing frames around their outer side. It is clear, as may also be seen from Fig., 4 and 5, which show the housing frames without a cover and only the upper housing frame, respectively, that the connection element 21 is only connected to the housing frame, which in use is located above another housing frame 2.

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As may particularly be seen from Figure 5, the connection element 21 projects over the lower edge 10 of the housing frame 2 and thus forms a projecting border 23, which in assembled condition is in abutment with the outer side of the lower housing frame.

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In order to improve the connection between two housing frames with one another, the upper bracing elements 9 of the lower housing frame 2 can furthermore be connected to the lower bracing elements 9 of the upper housing frame via a screw or the like. It becomes clear that the respective bracing are in fixed abutment to one another.

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Furthermore, it becomes clear from Figure 3 that the cover 3 can also be connected to the upper bracing elements 9 through a screw.

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Figures 6 and 7 show a cable storage according to the invention with a cable roller inserted in wall installation. The semi-circular base portion 6 is formed on the bottom facing the ground, and the opposing ends of the U-legs 5, 5' including the holding devices 17 are located in a position facing the cover. As may particularly be clear from Figure 7, the wound-up cable roller is in abutment with the inner side of the housing frame and is held in shape by the semi-circular base portion 6. Furthermore, the cable roller is prevented by the

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bracing elements 9 from falling out of the housing frame when removing the cover 3.

5 If in use additional cable is needed, either the entire roller located in the cable housing may be removed or only a certain amount of windings.

If several housing frames are stacked, a housing frame can be removed when the cable was completely removed therefrom.

10 As explained before, the insertion pattern of the cable roller is of significant meaning. The cable should be inserted such that certain portions of the cables are pre-twined in opposite directions, i.e. that in the case of a complete removal of the cable the twist or twine introduced by the winding-up process is compensated. An example of such a suitable winding-up pattern is explained in  
15 Figures 8 to 10 and a further pattern is explained in Figures 11 and 12.

As shown in Figure 8, the cable 25 is first of all laid in the shape of a circle, wherein the two cable ends 26 and 27 cross each other once on the crossing point 28. In this manner the circle 29 is formed. Subsequently a second circle is  
20 formed by cables ends 26 and 27 running on top of each other, wherein the crossing point 30 opposes the crossing point 28 and wherein the cable laid in that manner now has the shape of an eight. It is advantageous if the cable end 26 is guided over the cable 27 in each crossing process.

25 In a second step shown in Figure 9, the circle 29 is put onto the circle 31 so that the cable 25 reveals one single circle only.

If it is intended to store even more cable in the housing, steps 1 and 2 can be repeated, wherein the circle formed by the stacking of circles 29 and 31 forms  
30 the upper part of a new eight to be laid by cable 25, i.e. the cable ends 26 and 27 are once again guided over each other and the circle formed by the circles 29 and 31 is put onto a new circle 32.

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Another winding technique is shown in Figure 11 and 12. According thereto, a pre-twining or pre-twisting of the cable 25 can be achieved if the cable ends 26 and 27 change their position in each crossing process, i.e. during the first crossing process the cable 27 is located above the cable 2 and during the second crossing process the cable 26 is located above the cable 27. However, it is also required that an amount of windings that can be divided by two exists.